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SOUTH DAKOTA 2011 CROP FORECASTS

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Crops in South Dakota have, on average, maintained steady growth in harvested yields per acre.

Additionally, corn yields have seen a shift to a higher rate of growth beginning in the 1990s. Thus, production has trended higher. However, in any given year the yield is difficult to predict as weather and cropping patterns fluctuate. The 2011 *Acreage* report gives expected harvested acres that can be combined with the yield forecasts to obtain production estimates for corn, soybeans and wheat.

Data and Models

Yield data from National Agricultural Statistics Service (NASS) from 1971 to 2010 were used in linear regression models by crop. Data on acres planted, acres harvested and production are also from NASS. Actual 2010 data are given in Table 1 for comparison to the 2011 forecasts. Data from 2011 are from *Crop Production, Prospective Plantings* and *Acreage* reports. Models relating planted to harvested acres were also run by crop. The models are discussed by crop with a summary at the end of this article.

A regression relates the correlation between yield and time by finding a 'best fit' line. In a regression, the line is determined by minimizing the distance between all the points in which yield has fallen over

time. The regression will minimize the sum of the squares of the vertical distance between the points and the line. This number is squared to avoid the points above and below the line canceling one another out. Additional details of the models are available from the authors.

Corn

Average corn yield per acre in South Dakota has tripled in the past 40 years. A significant amount of the growth in yield has been in recent years. In the mid 1990s, corn yields increased at a faster pace, so an additional variable to account for changes in technology or production methods was added in 1996. This causes not only a shift in the trend line, but also a change in its slope. The model for 1996 forward is thus:

$$\text{Corn Yield} = 43.2 + 2.2 * \text{Trend}$$

Thus, *Corn Yield* (in bushels) is explained with a constant base of 43.2 plus 2.2 times the *Trend* value. Prior to 1996 the slope was only 1.7 bushels per acre. Using this model the expected 2010 yield was 131 bushels per acre, compared to the actual yield of 135 bushels per acre (Figure 1). *Trend* for 2011 is equal to 41. The 2011 forecasted yield is 133.4 bushels per acre (Table 2), less than the record corn yield of 151.0 bushels per acre set in 2009.

In the 2011 *Acreage* report there are 5,200,000 acres planted to corn in South Dakota, down 200,000 acres from the *Prospective Plantings* estimate. Excess moisture delayed planting beyond the optimal time in many areas likely explaining the drop in acres. The record level of planted acres was set in 1931 at 5,500,000 acres.

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Figure 1. South Dakota Corn Yield Trend

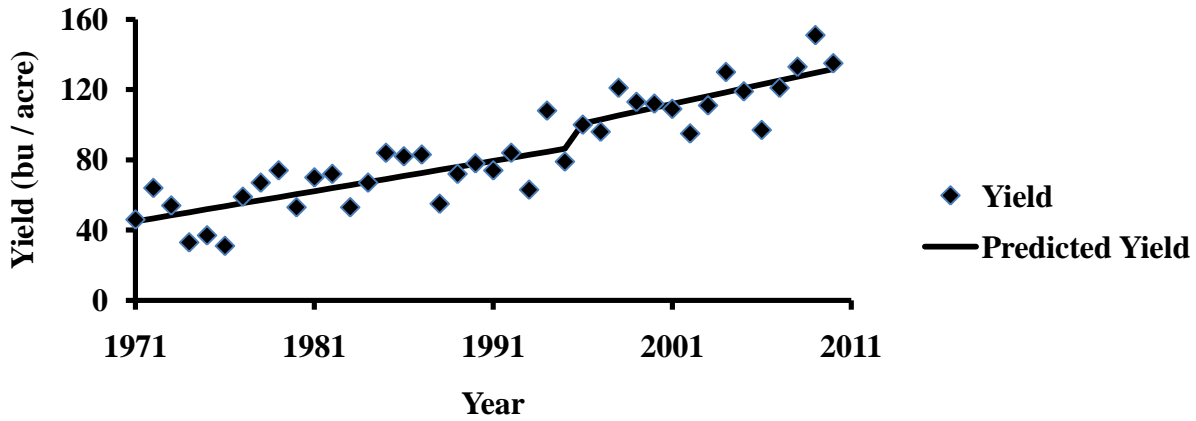


Figure 2. South Dakota Soybean Yield Trend

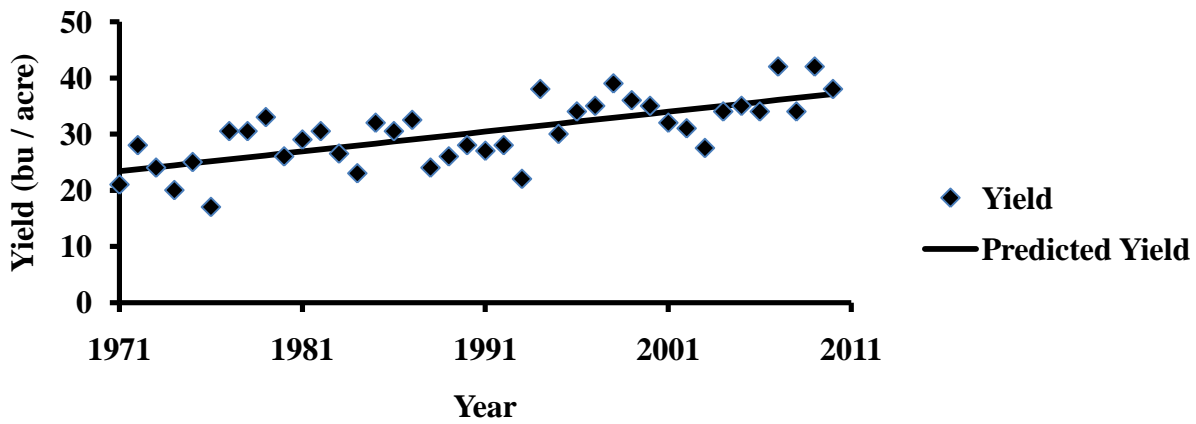


Figure 3. South Dakota Wheat Yield Trend

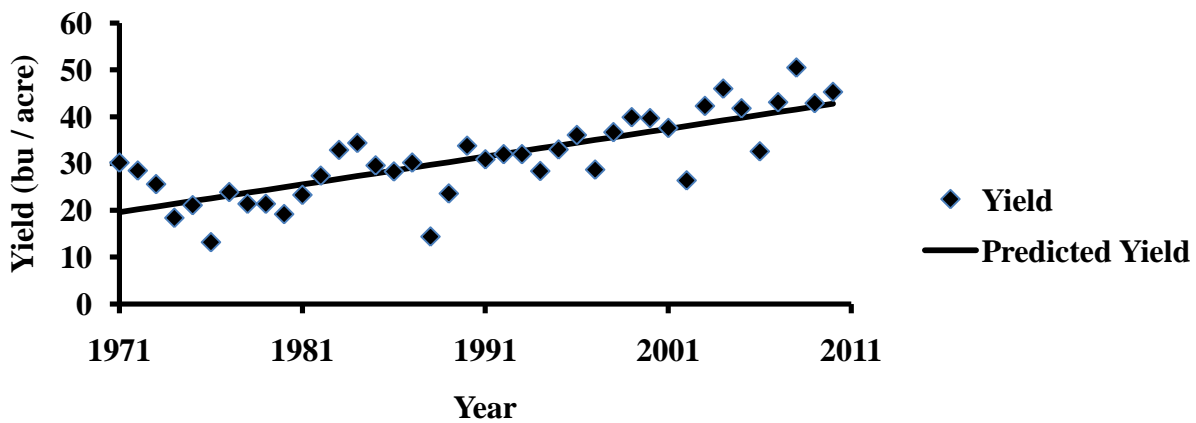


Table 1. 2010 yields, planted acres, harvested acres and production.

| Crop | Yield | Planted Acres | Harvested Acres | Total Production |
|----------|-------|---------------|-----------------|------------------|
| Corn | 135 | 4,550,000 | 4,220,000 | 569,700,000 |
| Soybeans | 38 | 4,200,000 | 4,140,000 | 157,320,000 |
| Wheat | 45.3 | 2,815,000 | 2,725,000 | 123,475,000 |

Source: NASS *Crop Production* report.

Table 2. 2011 forecasted yields, planted acres, harvest acres and production.

| Crop | Predicted Yield | Planted Acres | Harvested Acres | Expected Production |
|----------|-----------------|---------------|-----------------|---------------------|
| Corn | 133.4 | 5,200,000 | 4,800,000 | 640,320,000 |
| Soybeans | 37.4 | 4,300,000 | 4,240,000 | 158,576,000 |
| Wheat | 43.2 | 2,810,000 | 2,730,000 | 117,936,000 |

Source: Planted and harvest acres are from the NASS *Acreage* report.

In the *Acreage* report, producers expect 4,800,000 harvested corn acres for 2011. Such a level would exceed the record level of 4,680,000 harvested acres set in 2009. Using the *Acreage* figure for harvested acres results in a 2011 production estimate of 640,320,000 bushels. The record production level was set in 2009 at 706,680,000 bushels.

As an aside, there has been a statistically significant increase in the ratio of acres harvested for grain to planted acres (*H-to-P*). Planted corn acres has trended higher while corn acres intended for silage has fallen. The ratio was regressed on *Trend* and the resulting model is: $H-to-P = .6747 + 0.0065 * Trend$. For 2011 the forecasted ratio was 0.941 or 94.1% of planted acres from the *Prospective Plantings* report.

Soybeans

Soybean yields in South Dakota have grown steadily over the past 40 years. Unlike corn, there is no obvious structural change in soybean yields (Figure 2). To forecast yields the following model is used:

$$Soybean\ Yield = 23.0 + 0.35 * Trend$$

Thus, *Soybean Yield* (in bushels) is explained with a constant base of 23.0 plus 0.35 times the *Trend* value. The expected 2010 yield from this model shows 37 bushels per acre, compared to the 38 bushels actually harvested. The 2011 forecasted yield is 37.4 bushels per acre (Table 2), less than the record soybean yield of 42.0 bushels per acre set in 2009.

In the *Acreage* report there are 4,300,000 acres planted to soybeans in South Dakota, unchanged from the *Prospective Plantings* estimate. Planted acres are thus below the record 4,500,000 acres set in 2001. There is not a statistically significant change in the ratio of harvested to planted acres over time, which has averaged 0.984 or 98.4%. In the *Acreage* report producers expect 4,240,000 harvested acres, less than the record of 4,470,000 acres set in 2001. Using the *Acreage* figure and the yield forecast gives estimated production of 158,576,000 bushels, less than the record of 175,980,000 bushels set in 2009.

Wheat

Over the past 40 years, wheat yields have doubled in South Dakota. The expected yields for all wheat are analyzed here. The NASS estimates for winter wheat are not incorporated into these figures, but remain a potential area for further analysis. To forecast yields the following model is used:

$$Wheat\ Yield = 19.0 + 0.59 * Trend$$

Thus, *Wheat Yield* (in bushels) is explained with a constant base of 19.0 plus 0.59 times the *Trend* value. The expected 2010 yield from this model shows 42.6 bushels per acre, compared to the actual yield of 45.3 bushels per acre (Figure 3). The 2011 forecasted yield is 43.2 bushels per acre (Table 2), less than the record wheat yield of 50.5 bushels per acre set in 2008.

In the *Acreage* report there are 2,810,000 acres planted to wheat in South Dakota, down 205,000 acres from the *Prospective Plantings* estimate. Planted acres are considerably less than the record of 4,385,000 acres set in 1992. There is not a statistically significant change in the ratio of harvested to planted acres over time, which has averaged 0.887 or 88.7%. In the *Acreage* report producers expect 2,730,000 harvested acres, well below the record of 4,079,000 acres set in 1949. Using the *Acreage* figure and yield forecast gives estimated production of 117,936,000 bushels, less than the record of 172,540,000 bushels set in 2008.

Conclusion

The latest acreage figures show a small decline in planted acres of corn and wheat in South Dakota. The planted acres of soybeans are unchanged from March. The harvested acres of all three crops, if realized, will exceed 2010 levels. Based on trend models we have the following yield forecasts: corn at 133.4 bushels per acre, soybeans at 37.4 bushels per acre and wheat at 43.2 bushels per acre. The resulting production levels would exceed 2010 levels for corn and soybeans, but not for wheat.

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